Midwest Engineer

SERVING THE ENGINEERING PROFESSION

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

THE ENGINEER IN MANAGEMENT — PAGE THREE

Vol. 9 DECEMBER, 1956 No. 7

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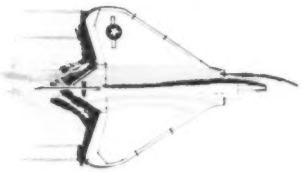

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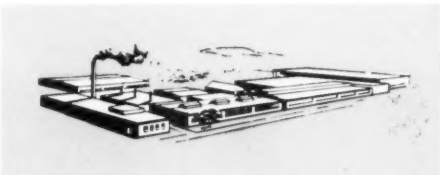

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WESTERN SOCIETY OF ENGINEERS

Serving the Engineering Profession

December, 1956 Vol. 9, No. 7

CONTENTS

COVER STORY

We are repeating the cover used on the December, 1954 issue, in view of the troubled conditions in Europe.

—Picture by John Kenneth Baker

January 16, 1957

Have you ever wondered

what happens at the other end when you dial your telephone? To give you the inside story of modern long-distance telephone operations, Western Society of Engineers is sponsoring an interesting and informative tour of Illinois Bell Telephone Company's Long Lines Division Toll #3 Building located at 400 W. 76th Street. The tour is scheduled for Wednesday evening, January 16, 1957 at 7:45 P.M. It is open to all W.S.E. members.

5:30 P.M. cocktails followed by a 6:00 P.M. roast beef dinner will be available at Western Society of Engineers Headquarters located at 84 E. Randolph Street. Bus transportation will be provided to and from the Long Lines Toll Building. The bus is scheduled to return the group to W.S.E. Headquarters before 10:00 P.M.

Three types of reservations will be accepted:

1. Dinner & bus
2. Bus only
3. Driving direct to the Toll Building

Because of the necessary security clearance, the deadline for accepting reservations is January 9. MAKE YOUR RESERVATIONS EARLY either by calling W.S.E. at RAndolph 6-1736 or by filling out the attached registration blank and mailing to: Western Society of Engineers, 84 E. Randolph Street, Chicago 1, Illinois.

Name _____

Address _____

Date and Place of Birth _____

Company Affiliation _____

Company Position _____

Citizen _____

The Engineer in Management

By O. W. Tuthill, MWSE

Possibly the dominant key to our economy today is the huge increase in consumer purchasing power which has occurred since World War II. Regardless of how fast purchasing power rises the consumer's money and credit will not let him buy all he would like to at any time. Therefore, he must be selective and choose from what is available those goods and services which give him the most satisfaction. This creates the intense competition we see on all sides for the consumer's dollar. Together with increasing military needs, this, in turn, is the driving force behind more and more research and development, which has created the tremendous need for engineers in industry.

Engineers are an integral part of the management team. As industry becomes more and more technological it requires increasingly large investments in plant, thereby placing added responsibilities on the engineer. An important responsibility of top management, therefore, is to create a climate that will foster maximum use of the engineer's managerial skills. I plan to give you a picture of how we are going about this by developing the following:

1. The need for engineers in my business.
2. The opportunities we have for engineers to advance anywhere in the business.
3. What we expect of engineers as managers and supervisors.
4. Some problems we found in developing engineers to become managers and supervisors.
5. How we exposed these problems with attitude research and measurement.
6. What we are doing to solve them and how it is paying off.

Our business is highly technical and is becoming increasingly so through the introduction of technological improvements such as electronic switching of calls, improved microwave systems, mechanized accounting and many others just over the horizon. Each provides a challenge to our people and each provides opportunities for the individual to develop and to advance in the system.

The increasing complexity of our business requires greater emphasis on operations research, which, in the last analysis, is the determination of the best way to do a job out of many possible combinations. It is the skills of the engineer that will be needed more and more to fully realize the potentialities of the things we see ahead.

There are in the Bell System some 12,000 graduate engineers, of which close to 7,000 are with the telephone operating companies. About 3,000 of these are in the engineering departments, and the balance in operating and staff functions in the other departments. Thus there is a large field for graduate engineers in departments other than engineering. Of the remaining 5,000 about 2,000 are with the Bell Telephone Laboratories, to a large extent associated with development and research rather than operational problems, and some 3,000 are with the Western Electric Company. The American Telephone and Telegraph Company headquarters organization has over 200 graduate engineers.

In order to care for the increasing magnitude of the engineering job in the Bell Operating Companies, the number of engineering positions has increased about 30 per cent during the past three years or about 10 per cent per year. In view of this large growth it would be expected that many engineers naturally would be in position to advance to supervisory jobs.

I have a chart—"Management Distribution by Education—District Level and Above—Bell Telephone Companies"—which you might find of interest. You will note in all Bell System middle and higher management jobs (third level of supervision and up) approximately 59 per cent of the individuals involved are college graduates, of which about two-fifths (2,200) have engineering degrees. The chart also shows the absence of a degree by no means precludes a man's reaching a high management position—about 41 per cent of the people in middle and higher management are not college graduates. A number of these people are in engineering jobs.

With reference to top management, that is, those above department head (chief engineer is a department head), better than one out of four of the incumbents have an engineering degree. The highly technical nature of our business has made it necessary that a substantial proportion of higher management have the analytical type of mind that goes with an engineering background.

What We Expect of Engineers as Managers and Supervisors

It is necessary that engineers have technical competence, but as we draw on so many engineers to fill higher man-

MANAGEMENT DISTRIBUTION BY EDUCATION
DISTRICT LEVEL AND ABOVE
BELL TELEPHONE COMPANIES

Level	Number of Men	Percent by Education			College Graduates Having Engineering Degrees	
		Non-College	Non-Graduate College	Graduate	Number	Percent
Above Department Head	289	10.7	13.5	75.8	79	36.2
Department Head Level	690	18.0	15.1	66.9	182	39.7
Division Level	1797	15.8	16.4	67.8	478	39.4
District Level	6576	25.5	19.6	54.9	1499	41.7
Total	9352	22.6	18.6	58.8	2238	40.7

Mr. Tuthill, General Manager — Merchandising, formerly Chief Engineer—State Area, Illinois Bell Telephone Company, presented this paper as part of the American Management Association Seminar, Chicago, September 10-11; New York, October 4-5, 1956.

MODERN OIL AND GAS FIRED BOILERS

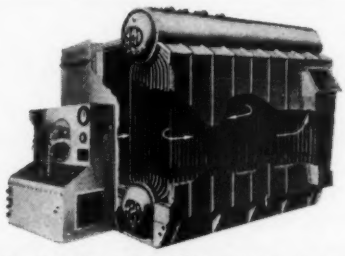
The boilers illustrated here cover the broad capacity range from 4,000 to 600,000 lb of steam per hr. They are all especially designed for gas and/or oil firing. The two units illustrated at right (Types VP and VU-55) are standardized and each is available in several sizes. The capacity range covered by these two units is from 4,000 to 120,000 lb per hr. The two units below are custom designed for various capacity, pressure and temperature requirements up to 600,000 lb per hr, 1400 psi and 950 F. All these units are pressure fired and do not require induced draft fans.

Collectively, they offer an exceptional diversity of choice. A brief consideration of the features of each type will help you "pinpoint" the design characteristics best suited to your particular needs.

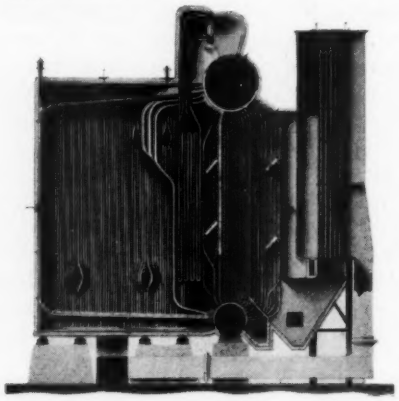
Of course there are other C-E two drum Vertical-Unit Boilers available for pressures up to 1400 psi and temperatures up to 960 F. Shown here are but four popular members of the C-E family of Vertical-Unit Boilers—a family which has achieved a wide measure of acceptance using all types of fuel.

Please feel free to call on us for further detailed information. Catalogs are available upon request.

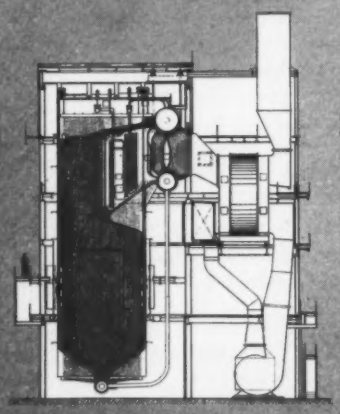
B-922-B



C-E Package Boiler — Type VP Completely shop assembled . . . available in fourteen sizes from 4,000 to 40,000 lb capacity . . . pressures to 500 psi. Available with integral console control panel, this unit contains more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. It can be equipped with any of several approved burners.

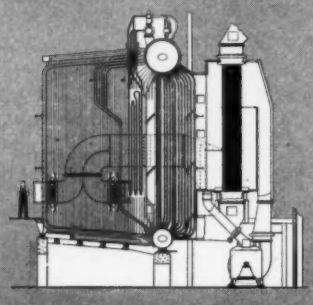


C-E Vertical Unit Boiler — Type VU-55 Available in six sizes . . . capacities from 50,000 to 120,000 lb steam per hour . . . designed for two pressure ranges, 250 psi and 500 psi, and total steam temperatures up to 750 F. This double cased, gas-tight unit is equipped with tangential burners. A large (60-inch) steam drum assures generous water capacity and steam reservoir space. Tangent tube waterwalls offer complete furnace protection, minimizing maintenance.



C-E Vertical Unit Boiler — Type V2

This unit is available for capacities from 200,000 to 600,000 lb per hr. It can be designed for pressures up to 1400 psi and for temperatures to 950 F. Tilting tangential burners, providing superheat control, are standard equipment although horizontal burners are available, if desired. A double, gas-tight casing assures lifetime tightness and minimum heat loss. Heat recovery equipment can be furnished as desired.



C-E Vertical Unit Boiler — Type VU-50B

This unit is available for capacities from 50,000 to 400,000 lb per hr—pressures to 1400 psi and temperatures to 950 F. This bottom-supported design uses tilting tangential burners providing effective superheat control. Horizontal burners can be furnished if desired. Heat recovery equipment as required. This unit makes available to industrial installations a standard of performance comparable to utility practice.

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agement jobs, it is also necessary that those chosen have the characteristics required to enter the ranks of higher management.

Merle Thorpe, in the *A.M.A. Management Review* of February, 1954, pointed out four common denominators that characterize the kind of manager I have in mind. They are:

1. Ability to visualize—to see the completed project before the first step is taken.
2. Ability to organize—to marshal human resources to get things done in the most efficient and economical manner.
3. Ability to deputize—to get the right man for the right job.
4. Ability to supervise—the quality of arousing teamwork; to make each man on the team feel that his part is as important as any other.

I would like to spell out these ability characteristics in more detail. As I see them in the engineer, they are:

1. Technical competence — knowledge of the engineering tools required to do his job.
2. Intellectual integrity—upper management must have confidence in his work.
3. Good oral and written expression —convincing presentation of his recommendations.
4. Know how to deal with people—team operation is required to get all the factors bearing on a problem.
5. Sound judgment — to select the best of several possible solutions—to know how exacting a job is necessary.
6. Understanding of economics—required for decision making.
7. Inquisitiveness—he must have the drive to originate.
8. Perseverance — to see things through.

In general, this points up what we all know are the characteristics required of a good manager anywhere, whether he be an eningeer or not. As you know, it's quite another problem to find people who have these characteristics. However, by working in the right climate on the day-to-day job, people can be developed —engineers as well as others—to be better managers.

Problems in Developing Engineers to Become Managers and Supervisors

Certain characteristics which engineers tend to acquire result, first from their type of education, and, second, from their work environment once they enter business. They are taught the practical approach to things—to keep their feet on the ground. Their concentration is with material things rather than people. As a result, even the experienced engineer sometimes doesn't look beyond the purely technical aspects of his job. Success of a product requires, for example, that marketability be as important a factor as workability.

When the latest model telephone was designed, the numbers and letters were placed on the outside of the dial rather than on the inside where they had been on earlier models. A market test of the new telephone soon showed that our customers couldn't dial quickly and accurately to the degree required until a tiny white target dot was placed in the blank spaces inside the dial holes.

There seems to be a tendency in business to organize line departments into geographic divisions broadly administrative in character, at least at management levels, and to organize engineering departments into functional or specialty groups in order to foster expertness and creativity.

When engineers enter business they are frequently placed in an organizational environment of the latter type, where the basis for promotion has been largely technical competence. In a large organization there could be three levels of supervision between the engineer who has been assigned a particular job and the department head, the Chief Engineer, each level being represented by a technical expert.

With that type of organizational structure, as a project proceeds upwards in the organization, each level of supervision may, if it chooses, analyze it from an expert's point of view. If this is done, it can produce the following:

a. The supervisor continues to do detailed engineering work rather than delegate.

b. The engineer at the bottom of the ladder becomes bogged down getting information that he thinks might be pertinent so as not to take any chance before passing a job along. This impairs any feeling of proprietorship and has a tremendous bearing on morale and performance.

c. A departmental point of view instead of a Company one. Factors not readily susceptible to dollars and cents measurement may be disregarded.

d. Impairment of communications up and down the line.

The engineering organizational structure can have a definite bearing on engineering quality—as well as on morale. The size of an engineering organization, of course, can be an important factor in

this respect. However, irrespective of organization, observation has shown that problems such as these must be squarely faced to provide good engineering supervision.

The **Western Society of Engineers** canvassed a group of industrial leaders a few years ago to get their views as to the deficiencies they saw in the engineers they employ. Of the many replies received, I'd like to quote from one as it mentions several of the characteristics we expect of engineers as managers.

"In general I think the great majority of our managers feel that engineers are well prepared for engineering management from the standpoint of technical knowledge and engineering skills. Although the deficiencies of engineers are no greater than other professional groups, they are short on business knowledge, management techniques, and human relations skills. In most engineering problems, economic factors loom large in the final decision. In industry the engineer must be a businessman as well as a scientist. The trend toward specialization in industry has presented problems in developing men for management. The engineer who is highly specialized in one field has difficulty in striking a balance in dealing with the multitude of problems with which he is confronted, for he has the tendency to think along the lines of his own specialty."

Attitude Research and Management

A central management objective in the Engineering Department is to make sure that when an engineer has people reporting to him he is a skilled supervisor as well as a good engineer. No organization can contribute its full share towards the success of the enterprise without supervisors who really understand their people. We have done extensive research on the relationship between supervisors and subordinates and find that the good boss, especially the human side of him, is the most important working condition. The supervisor's attitude is the chief ingredient of the social skill he needs to be a good boss. Attitudes — both of supervision and the rank and file — are relatively easy to measure.

We have made several surveys of management people, each consisting of over 100 questions covering 17 principal categories. In addition, we have a category called the General Management Attitude which is made up from certain questions in the other categories and which provides a single measure of the more general aspects of attitude. Spontaneous answers are sought to the questions rather than ones that are carefully thought out.

For example, an important category is "Attitude Toward Supervision." Some typical questions are:

a. Do you think that your supervisor would give you a fair hearing on any subject you would want to bring up?

**Always
*Usually
Seldom
Never

**An "always" answer gets full credit for the question.

*A "usually" answer gets half credit. Other answers get no credit.

b. How do you feel about the amount of appreciation and recognition you get when you do a good job?

**Entirely satisfied
*Quite satisfied
Only fairly satisfied
Not at all satisfied

c. How much real interest does your supervisor have in *you* as a person?

None at all
Not very much
*Quite a bit
**A great deal

The answers, which are anonymous, obviously are not precise. They do, however, represent the real feelings of people. We have gone back and made checks of the questionnaire answers by conducting personal interviews on a random basis. The substance of the interviews checked with what he had found from the anonymous questionnaires.

Numerical score on an attitude survey is relatively unimportant because no one knows what is par. A comparison between different groups and a study of the trends are highly significant and point the way to intelligent action.

I have a chart which shows the scores of an Engineering Department in each of the 18 categories. The Attitude Survey was taken in 1952. The zero line on the chart represents the total System results equated to a norm. (See page 8.)

You will note the Engineering scores were well below the zero line in the categories of Confidence in Management, Pride in Company, Job Satisfaction, Personal Satisfaction, Attitude Toward Supervision, Communications, Identification with Management and General Management Attitude.

Also, I have the scores of an Operating Department where the management people are predominantly male. The Operating Department includes some

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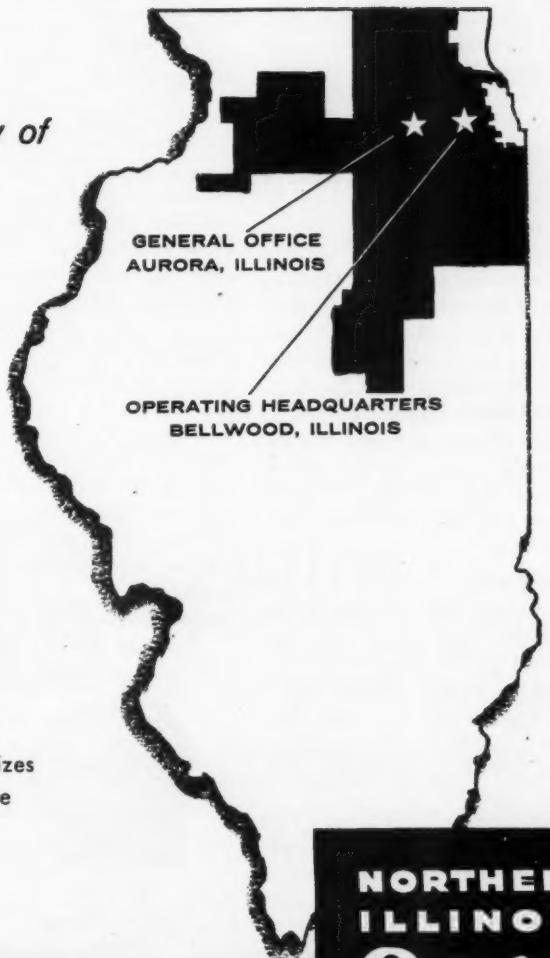

Northern Illinois Gas Company, which now serves more than 550,000 customers, is one of the fastest growing natural gas distributing companies in the country. Over 265,000 customers have been added to our system since 1940, an increase of 92 per cent. This trend is continuing and by 1960 we estimate that more than 357,000 customers will have been added during this 20-year period.

In this rapidly growing Company there is plenty of opportunity for young engineers to grow, too. Many fine positions in the Company are now held by engineers who began their utility careers eight to ten years ago. Currently, four out of five college graduates we hire are engineers. This further emphasizes the place engineers have in our Company. If you are interested, write or visit us at:

615 Eastern Avenue, Bellwood, Illinois

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graduate engineers. By superimposing one set of scores on the other it can be seen that the over-all General Management Attitude, as well as Confidence in Management, Pride in Company, Job Satisfaction, Personal Satisfaction and Identification with Management, was higher in the Operating Department than in the Engineering Department.

You will note that financial knowledge in the Engineering Department was substantially higher than in the Operating Department. This is what we might expect due to the fact that the Engineering organization is responsible for the economics of plant investment.

In addition, I have scores of the total Company in the 18 categories. These scores represent the results for all management personnel. You can see here, as with the Operating Department, the over-all General Management Attitude, as well as Job Satisfaction, Personal Satisfaction, Pride in Company, Confidence in Management and Identification with Management, ran higher than in the Engineering Department.

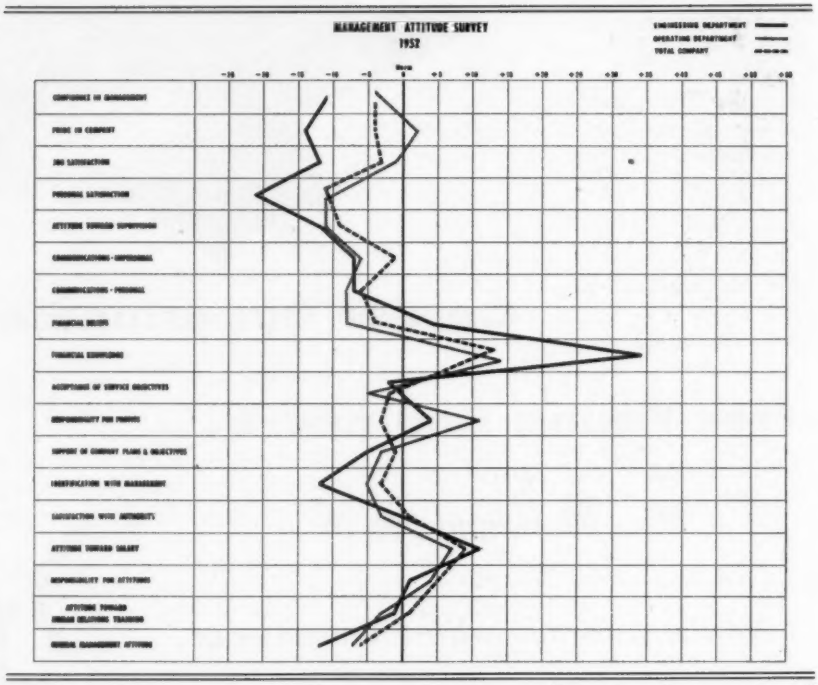
In addition to the questions, the Attitude Survey Questionnaires contain space for written-in comments. Many of the comments give us good leads as to where action is desirable. I would like to read you a few of the critical comments made by members of the Engineering Department because they illustrate dramatically the problems of making good engineers into good supervisors. For the record I would like to point out we also get many favorable comments.

Communications

"I've had three jobs canceled in the last six months, I don't know why they were canceled, my boss doesn't know, I can't ask him because the guy above him doesn't know or won't tell him. I think that's one of the biggest things you have to overcome, is to *tell a man why*."

"The Section Heads go to meetings on various jobs. They get all the information . . . but *nothing ever comes down to us* . . . the situation is getting worse, not better."

"Getting back to comunications—so often information concerning the job is hoarded by a section, rather than passing it to all sections within a division and and also to all divisions within the department. So often one section acquires



a feeling of importance to the Company and sorts out the useful information and keeps it as its own. However, this section that has acquired so much self-importance should be made to realize that the Company is not resting on its shoulders. To get the maximum efficiency, all sections, *all divisions* within the Engineering Department *must work as a team*. This can be done only if all sections receive all the information available. With the various duplicating processes available to the engineers, there is no reason why copies of important information cannot be made and the original passed on."

Supervision

"I would like to know more about Company policies but the questions I want to ask I don't want to ask of my immediate supervisor in view of the fact that he would often be the subject of those questions. Now if you don't mind, I'd like to make a little speech. Regardless of what higher management says or would like to see done, the 'bloke' I and all the other employees have to please is the immediate supervisor. Regardless of how much training you give the immediate supervisor, he can still be a lemon when it comes to handling people. And when you get stuck working for a lemon it isn't much fun going to work. I wish I could like my job but I just can't because of the boss I've got, and I know plenty other

people in the same boat. I want to make this one recommendation: Don't make an employee work for the same boss more than four years. Give him a chance to change jobs or change the boss. I've worked at my present job for five years now and *my boss never consults me* on anything regarding how the job should be done. He makes arbitrary decisions and lets me know about it in such a way that I cannot question the decision without looking like I'm questioning his authority. Let's give the employees more chances to change bosses. This Company treats its employees swell and I mean it."

"It is difficult to get a decision from my supervisor. Since he moved into a private office he has lost contact with his people, their problems, and their work. He no longer knows the production or the capabilities of his people. He tries to apply the Human Relations touch but misses in practice. The responsibility of his job and the problems in it are getting beyond him, while *he buries himself in clerical and useless details.*"

Personal Satisfaction

"I feel that *my present job has small chance of advancement.*"

"There is a lot of work a supervisor is asked to do these days—reports and things of that sort that could be delegated to a clerk in an office or something of that sort so the supervisor is out with his men and associating with them and training them. I think in the long run it would be a lot better."

Satisfaction with Authority

"The most important lack in incentive to do a good job is that nearly everything done must be approved by someone above. I would suggest that *every employee* down to messenger boy or girl *should have at least one thing that he or she can run with no reversals* from above. I believe many employees go into outside activities (lodge, boy scouts, etc.) so they can be a 'big shot' somewhere. Work should give this opportunity."

"My main 'gripe' and only real dissatisfaction is that *my hands are often tied* for the lack of a policy decision from my immediate supervisor."

"It seems to me that *a better over-all job could be done if every level of supervision was given greater leeway* in making decisions, given more authority with assurance that the higher supervision would not reverse or criticize unduly. In general, we have capable, sincere employees in supervisory jobs but they are seldom able to do their best job because of this restriction."

Good engineering work requires top performance by everyone. This can only be obtained by engineer supervisors who have plus attitudes and who know and practice the human art of being a good boss. The most successful of such supervisors will be the ones who give their subordinates the opportunity and training to be as good bosses as they are engineers.

What We are Doing to Develop Better Managers

No engineer, nor anyone else, will ever be developed for management responsibilities by sitting still and expecting someone else to do it for him. Preparation for positions of leadership is, to a large extent, an individual responsibility. However, management has the obligation to provide the climate and opportunity for the engineer to develop himself if he chooses to do so.

William B. Given, Jr., in the *Harvard Business Review* (January-February 1955) writing under the title "The Engineer Goes Into Management," expresses very well, in my judgment, the problems we sometimes make for ourselves in setting the kind of climate I have in mind. I quote from his article as follows:

"The fact that so many men trained in engineering are classified as being unable to become top notch executives is not entirely their own fault. Thousands of good engineers have been hired impersonally by Personnel Departments of large organizations to fill jobs behind drafting boards or test tubes. Undoubtedly, many potential business leaders have become buried because management did not take the time or did not care to know and evaluate these people. While it is certainly up to each engineer to keep his eyes open, it is also a duty of the company itself to teach him what other things besides his daily engineering tasks are important.

"I think it is only after the engineer becomes lost in his daily formulas and tables and designs that he becomes the 'typical engineer.' If he is not exposed to the problems of management and does not get an opportunity to know of or work at other than his engineering work, he probably will become, consciously or unconsciously, too much of an 'engineer only' ever to succeed in management."

We are taking major steps to provide a proper climate for self-development. I think they can be grouped in four general categories as follows:

1. Activities associated with the improvement of attitudes.

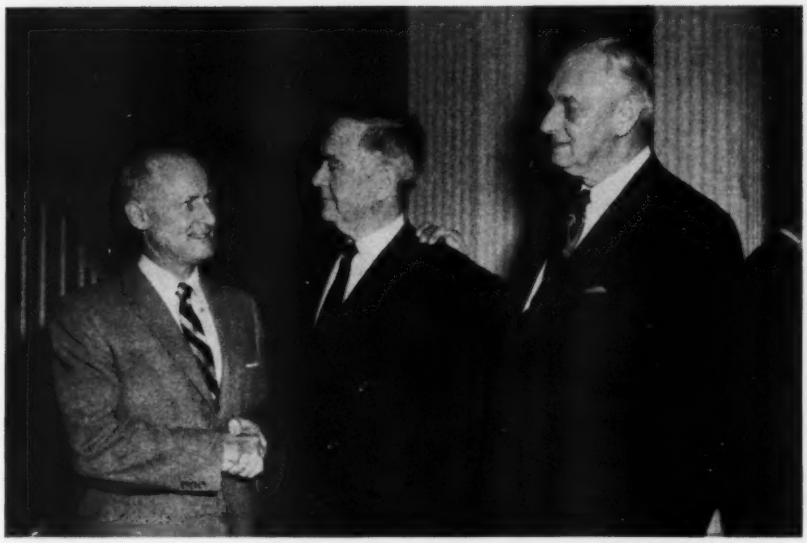
(Continued on Page 19)

Western So
Annual Di

Charles L. Mee
Joseph Kucho
John P. Gnaedinger

Albert P. Boysen
John F. Sullivan, Jr.
Frank V. Smith
Robert H. Bacon
Dick Van Gorp

ern Society ual Dinner



George L. Jackson (WSE President)
C. Hamilton Moses (Speaker)
Albert P. Boysen

On November 19, friends and members of the Western Society of Engineers gathered at the Union League Club in Chicago to hear an address by C. Hamilton Moses. This esteemed speaker, rated as one of the top one hundred in America, is a highly successful attorney. He is also retired chairman of the board of the Arkansas Power and Light Company.

In the picture at top left is a general view of the dining hall. Other pictures show persons (named from left to right) seated at the speaker's table.

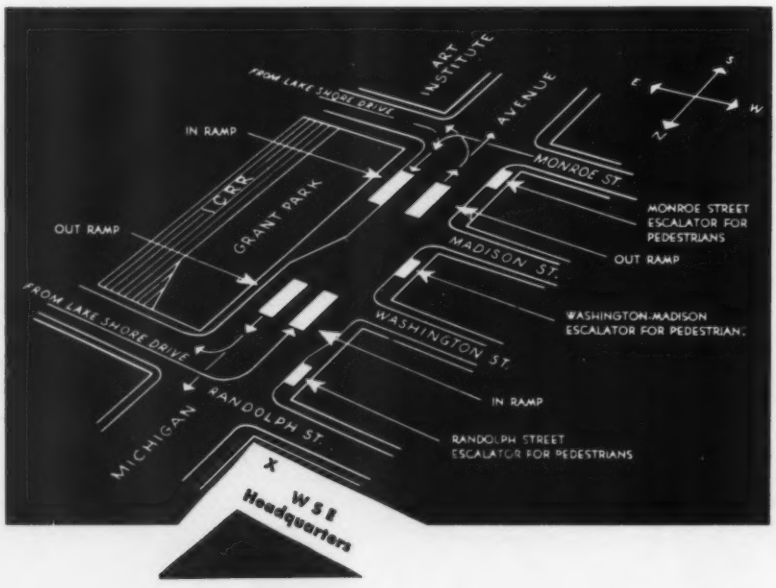
William R. Marston
Hjalmar W. Johnson
C. Hamilton Moses
George L. Jackson

SAY, ENGINEER!

Do you like to DRIVE?

Then why not drive to WSE meetings and other functions? There's plenty of PARKING almost at the door—the Underground Garage is diagonally across the street from WSE Headquarters (see the map below), two private garages are a block west, and the State-Wacker "Bird Cage" Garage is only a short distance away.

Below: map showing Park Department Underground Garage



Interior view of Underground Garage

If you're not driving it's still convenient to get to and from WSE meetings.

Here are handy stations or stops:

- The Cab Stand is just across the street
- The Elevated is one block west
- The Subway is two blocks west
- Buses stop at the door or within a few blocks for every part of town
- The IC Suburban station is across the street
- Other suburban stations are conveniently served by bus or elevated.

You see, your WSE Headquarters is at the handiest place in Chicago.

ENTER at either Monroe or Randolph Street on Michigan

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CAPACITY The garage with its 2359 parking spaces, is designed to prevent overcrowding.

Reinforced Plastics Make Gain

Reinforced plastics are penetrating volume markets formerly held exclusively by die cast aluminum, porcelainized steel and molded plywood, the Reinforced Plastics Division of The Society of the Plastics Industry, Inc., reports in its review of 1956 and forecast for 1957. Reinforced plastics are the sturdy family of materials which combine plastic resins with fibrous reinforcements to make a wide variety of products from boat hulls and building panels to fishing rods and furniture.

The industry recorded a 30 per cent gain in sales in 1956 as compared with 1955 and predicts an equal percentage growth in 1957. More important than volume, however, in the opinion of industry leaders, is the entry into solid new markets and the growing number of structural and semi-structural components in building and in all forms of transportation. Equal importance is assigned to the widening manufacturing base for reinforced plastics due to the entrance into the field by compression molders and by old established manufacturers, many of whom are investing substantial sums in reinforced plastics development and research.

In reporting on the growth of the industry, Clare E. Bacon of Owens-Corning Fiberglas Corp. and chairman of the Reinforced Plastics Division, credited advances in processing which have brought the reinforced industry closer to the goal of "parts per minute" rather than "minutes per part." Improvements in finish to a point where surfaces suitable for appliance parts are now possible and better understanding among designers and engineers of the design and use flexibility of these materials are two other important growth factors, he said.

The advances in processing involve faster curing resins, new types of compounds and better materials handling methods. For example, the development of premix compounds, combining resins and short chopped reinforcing materials, has made possible the injection and compression molding of reinforced plastics. New and improved preforming equipment and processing have also been developed that substitute mechanical for hand labor, thus more nearly approaching the automation of injection molding. As a result, many established compression and some injection molders are now entering the reinforced plastics field—on the one hand using their injection and compression presses to mold reinforced plastics and on the other adding preform equipment and departments. Advances are also being made in the hand lay-up phase of the industry with the result that very large units, 40-foot boats for example, can more easily be made in one piece.

The improvement of surface finish of molded parts has been achieved through the use of improved reinforcing mats, overlay mats, veils and fillers. It is these new techniques that make possible finishes suitable for appliance parts.

Particularly fertile fields for reinforced plastics in the year ahead, according to Bacon, are the whole transportation industry (including passenger cars and trucks, airplanes, boats and railcars), household appliances, furniture and seating, containers, construction and electrical components.

The present production volume and the potential for reinforced plastics among automobile and appliance manufacturers can be traced, Bacon said, to two main factors: one, reinforced plastics' ability to be formed in large one-piece units with attendant savings over multi-part production and assembly and, two, use, in some cases, of less costly tools in the forming of these materials.

Production of reinforced plastics automobile bodies continues at an increased rate and tooling for the next model of the Chevrolet *Corvette* is now underway, but the volume growth of reinforced plastics in cars is in components—for heater and air conditioner housings, instrument panels, fender fins, trim panels and "hardtops." In 1956, for example, one automobile manufacturer has tooled to produce dash panels of reinforced plastics for all his cars—a panel so designed as to fit all models. In fact, all five passenger car manufacturers — General Motors Corp., Ford Motor Co., Chrysler Corp., American Motors Corp. and Studebaker-Packard Corp.—are today using reinforced plastics for some body components.

In the appliance field, Westinghouse Electric Corporation is working on the idea that reinforced plastics can help solve appliance manufacturers problems of "planned obsolescence" by making it economically feasible through lower tooling costs to turn out shorter runs of a model. Their new built-in refrigerator is made from a single flat sheet of sandwich material combining reinforced plastics, styrene foam insulation and styrene alloy. Typical of other appliance housings being formed of reinforced plastics are the U. S. Air Conditioning Corp.'s home window air conditioner, the American Floor Surfacing Machine

Co.'s scrubber-polisher and, on the industrial side, the Gardner-Denver Co.'s air hoist, the IBM card sorting machine, the Fischer & Porter Co. chlorinator and the Kennard Corp.'s cooling tower.

Working parts as well as housings and, in the case of automobiles, body components are also being made of reinforced plastics. Chrysler Corp., for example, uses reinforced plastics for motor fans and for parts of its automatic transmissions. These materials also are used for Chris Craft clutch parts, Laundromat and Norge washing machine parts, and Kelvinator, Frigidaire, and Westinghouse refrigerator components.

Attesting to the strides being made in structural and semi-structural application of reinforced plastics are the reinforced airplane wings recently announced by Fairchild Engine and Aircraft Corp. Reinforced plastics are, of course, familiar and accepted materials for industrial glazing and skylighting, for patio covers, awnings, interior partitions. But many architectural uses, both in transportation and building, are still in the prototype or the limited production stage. However, as in case of the one-piece washroom and car steps in the Budd Co.'s prototype railcar *Pioneer III*, reinforced plastics hold promise of savings through reduced production and assembly costs, lesser weight and minimum maintenance requirements.

A spot check of the Reinforced Plastics Division on the West Coast laid stress on the fact that the field of structural and semi-structural aircraft components is ripe for invasion and development. This regional report also singled out as important to the reinforced plastics industry military transportation, the furniture field, sporting goods and pipe. It pointed out that while strategic and tactical modifications may eventually obviate the need for the LCVP military craft that have made use of reinforced plastics for an appreciable time, the present situation looks like procurement of newer types may be indicated. The furniture field, this West Coast report went on to say, will stand further exploration and may include such related items as cabinetry for electronic equipment, both military and commercial, and for household consumer goods such as TV cabinets. Reinforced plastics pipe is rapidly advancing in technology and oil and gas producers are studying and buying as is the chemical industry which is looking for materials to solve the problem of costly corrosion.

In the Midwest, according to reports from members of the Reinforced Plastics Division, fields holding great promise for reinforced plastics are the automotive, building and electrical. For example, the home trailer industry which abounds in the Midwest is actively investigating the use of these materials in mobile home construction and one manufacturer will have a complete reinforced plastics home-on-wheels in the near future. As seen in the Midwest, the reinforced plastics industry is stabilizing into good basic applications.

The industry anticipates announcement of new products and further improvements in processing techniques at the 12th Annual Technical and Management Conference of the Reinforced Plastics Division of the Society of the Plastics Industry, Inc., to be held in Chicago, Feb. 5, 6, and 7, 1957, at the Edgewater Beach Hotel.

Right and Wrong

You may sometimes be much in the wrong in owning that you are in the right.

— Poor Richard's Almanack

Electronic System To Analyze Generator

An electronic system designed to analyze the operation of a giant steam generating unit in a few hours—a task ordinarily requiring weeks of work by a team of specialists—has been developed jointly by The Babcock & Wilcox Company and The Bailey Meter Company.

By means of "sensing" elements linked to analog scanners, the system can probe hundreds of different boiler locations. At the touch of a button, it begins gathering such data as temperature, pressure, and gas composition. Complex electronic devices, operating without human guidance, then sort the information, supplement it with pre-set figures, and punch it in code on continuous tape.

Tape readings are transmitted by teletype to New York City, where B&W has a large electronic computer. Translated automatically into code suitable for computer use, the information is processed mathematically and transmitted back to the boiler site for application by engineers and technicians.

The new system has been developed to help engineers determine quickly and economically such boiler problems as sources of heat losses, the most efficient types of fuels, and when and where to

remove combustion waste deposits. Emphasizing the need for a method of correcting material or operating faults promptly, B&W authorities pointed out that boiler malfunctions and abnormal fuel consumption may continue for weeks under ordinary trouble-shooting methods. They said that the system also represents an effort to conserve critically short engineering manpower by reducing the number of personnel and the amount of time required to conduct boiler analyses.

The "brain" of the system is a centrally located electronic coordinating unit developed at the B&W Research Center at Alliance, Ohio. A special "scanning" device created by The Bailey Meter Company of Cleveland makes it possible for the system to gather data from widespread points of a boiler. Each scanning unit collects information from 25 different sensing elements. Any number of these devices may be hooked up with the system, depending on the quantity and location of points from which information is desired.

Recently the system underwent performance tests at the West Penn Power Company's Springdale, Pa., station, where it was used to gather data from 140 locations of boiler number 88.

Potentials of the new equipment will be more fully realized B&W officials believe, when it is applied later this year to the first of three steam generating units of a new type being built by B&W on the American Gas and Electric Company power system. This unit, located at the Ohio Power Company's Philo plant, near Zanesville will utilize the highest steam pressure and temperature ever employed in the commercial production of electric power.

Data will be gathered from 500 different locations of the Philo unit, compared with 140 at Springdale. Successful operation of the system on this unit, B&W officials feel, will conserve both manpower and money during the boiler's "proving out" stage, and provide performance data of a type unobtainable in the past.

Spokesmen for The Bailey Meter Company, which plans to make the new equipment available commercially if it proves successful, said that the system has been designed primarily for the analysis of large steam generating units. They added, however, that it should be adaptable to smaller boilers or boiler elements, and capable of being moved readily from one boiler to another.

In future tests, officials of the two companies revealed, the system will be applied not only to boilers, but to a broad range of equipment used in conjunction with them. They said that the system may shed new light, for example, on the combined operating efficiency of turbines and auxiliary equipment used to produce and distribute electric power.

Hooven Advises New, Prospective Engineers

The nation's new and prospective engineers were called on November 3, by Morris D. Hooven, engineering executive at Public Service Gas and Electric Co., Newark, N. J., to prepare themselves adequately for assuming tomorrow's "intellectual leadership" and conquering the world's new frontiers. Hooven was the principal speaker at an engineers' convocation at the University of Rhode Island.

He pointed out that while virtually all of the physical frontiers have been conquered, preventing further lateral progress on the globe, there are new challenges to meet in the "glittering galaxies of space" and in the earth's sub-surface areas.

Hooven, a graduate of Bucknell University, Lewisburg, Pa., and a past president of the American Institute of Electrical Engineers, has long been concerned with the problems of properly preparing engineers for the future tasks which face them. He again called for a comprehensive education for engineers "no portion of which, whether it be in the arts, sciences, or technology, should be neglected." "The Engineer of Tomorrow," Hooven said, "must be a man of broad education and deep culture, capable of leading his people beyond the frontiers of his day."

The engineer was urged by Mr. Hooven to take a more active interest in the practical problems of his community as further preparation for assuming tomorrow's leadership. "The real question which the engineers must answer," he said, "is whether or not we (the engineers) are meeting the problems of the community."

This urge to participate in community affairs, Hooven observed, may come more naturally if the Engineer of Tomorrow should turn out to be, in many cases, a woman. "The time must come when womanly grace and intuition will be added to the (engineering) profession," he said.

On Buying

Many have been ruined by buying good penny-worths.

— Poor Richard's Almanack

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1956-1957

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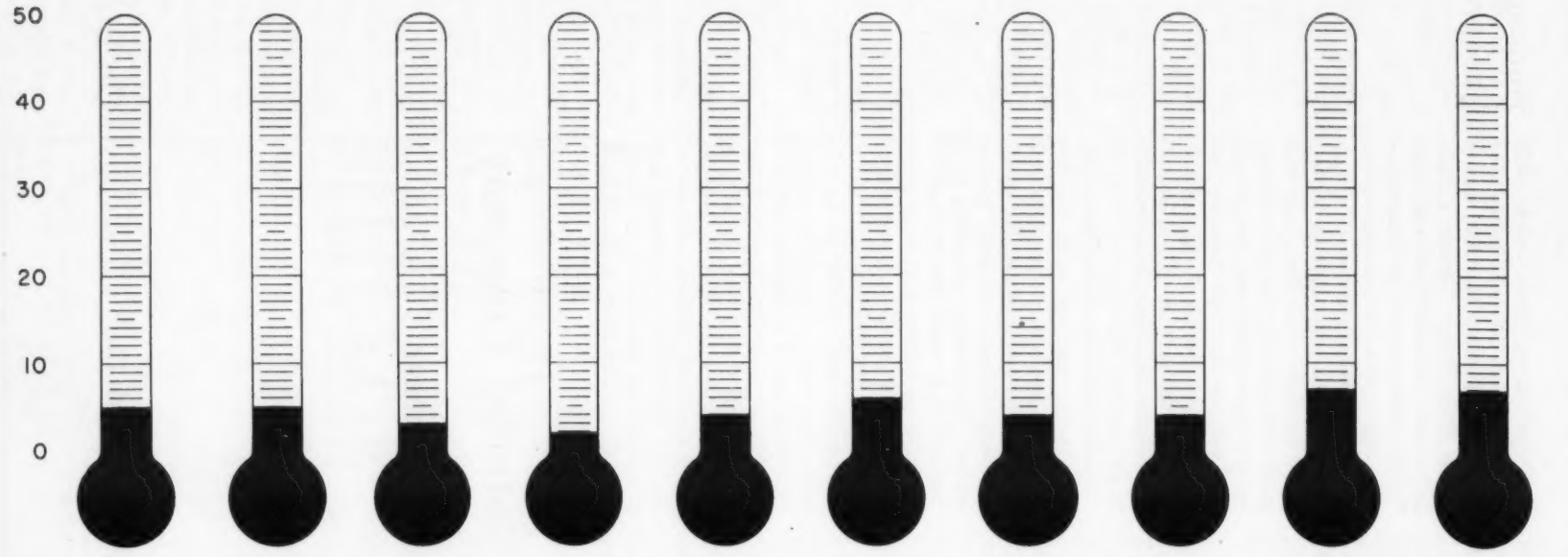

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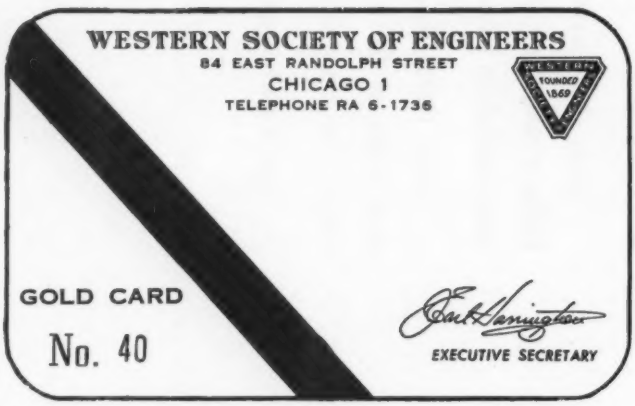

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Engineer in Management

(Continued from Page 9)

2. Analysis of job content to make certain the job an engineer is assigned will offer a challenge to his abilities.

3. Analysis of organizational structure to be sure it fosters maximum job effectiveness and development of people.

4. Training in the broad field of management responsibility.

Activities Associated with Improvement of Attitudes

The degree of success we attain in molding favorable attitudes depends, in large measure, on our attention to human values in the day-to-day job. An engineer, like anyone else, must accomplish his objectives through people. Some of the steps we have taken in this field are as follows:

1. In the broad field of human relations—

a. All engineers are included in discussion groups on human relations in management.

b. Considerable effort is placed on improved communications both up and down the line. Samples of what is done are:

(1) On a rotational basis District Heads are invited to attend the weekly meetings of the Chief Engineer and his Division Heads.

(2) Departmental meetings with management personnel are held in small groups at which time departmental policy is developed through discussion.

(3) Steps are taken to see that each member of the Department is kept advised of all items of general interest.

(4) An Open House was held for the families of members of the Engineering Department. Demonstrations were made of the types of work done. This gave employees' families some familiarity with the work, as well as an opportunity to meet members of the Department.

c. The personal and professional interests of the engineers are promoted in every practical way—emphasis is placed on treating each engineer as an individual and as a member of management.

d. A carefully supervised plan of rotational training, far more extensive than previously used, has been introduced.

e. The open door policy is emphasized from top to bottom so that each member of the Department feels free to ask any questions or discuss any problems. Conscious effort is directed towards having supervision friendly and helpful at all times.

f. Training in talking with people in the understanding-listening technique is given to all personnel.

2. Authority is delegated along with responsibility. This points up the fact that the engineer is a member of the management team even though he might have no one reporting to him. He is given the authority to make decisions within certain limits. If questions arise about his jobs he is called in and becomes a party to any changes that are made.

3. Salary treatment for each engineer is closely watched. Outstanding individuals are given appropriate recognition.

Analysis of Job Content

Cases were found where engineers were overloaded with work of a routine nature—where we were not making full use of their talents. Two important steps were taken—

1. Jobs were analyzed to determine if an engineer was required or whether the job could be done by a technician.

2. Engineers, where necessary, were given clerical assistants or access to a clerical pool to handle the large volume of clerical work that is associated with any engineering project. This left the engineers largely free for creative engineering work. Of course, any manager, no matter in what level of the organization, has to spend some time on work of a routine nature.

The September 7, 1956 issue of the *Wall Street Journal* has a lead article under the heading "Brain Conservation —Firms Battle to Take Administrative Chores Off Creative Engineers." This describes specific steps being taken by International Business Machines, General Electric, DuPont and others to resolve the serious problem of engineer shortage by freeing engineers from non-tech-

nical work and by training technicians to take over non-creative tasks. As you know, this is an important problem in industry today.

Analysis of Organizational Structure

Activity in this field involved such things as the following:

1. The number of people reporting to each supervisor was reviewed and in some cases reductions were made.
2. Engineers, where warranted, were placed as supervisors of technicians and clerks.
3. Specialists, who of course fill a very important role, were placed in the category of consultants for the entire department.
4. Job assignments, where practicable, were made on a geographic or other basis which would provide proprietorship and identification with management.

Training in Management Responsibility

The System has undertaken a program of management development, with which you may be familiar, called the Bell System Executive Conference. It is located at Asbury Park, New Jersey. This conference involves a four week program and all department head personnel, such as Chief Engineers, are included. It has been underway for about three years.

In addition, certain of the operating Companies have introduced a program of development conferences for levels of management below department head including newly employed college graduates. My Company (I.B.T.) has undertaken such a program which covers a two week period. The conferees during the fall, winter and spring, are brought together at Chicago. During this past summer we experimented with a different environment by holding the conferences at Knox College at Galesburg These conferences were described in the August 25, 1956 issue of *Business Week* under the title "The Boss Moves Into the Dorm."

The major purposes of the development conferences are:

1. To broaden the thinking and the outlook of telephone management people.
2. To increase their present effectiveness.
3. To stimulate their interest in further self-development.
4. To induct newly appointed management people.

At the end of every conference, each participant fills out a questionnaire, which is anonymous, commenting on the program. I thought you might be interested in a few of the types of comments that recur frequently.

"I thought I knew the answers before, but after listening to the other fellows in discussions, I realized there was much more to the problems than I saw."

"The greatest help I got out of the Conference was a chance to school myself and learn when to listen and when to speak my piece."

"With this experience I feel I can work more effectively with others, and also use better judgment in preventing and solving human relations problems. It started a new line of thinking for me."

"Another value, to me, of the Conference was the association with other departments. It gave us an opportunity to learn more about how the other departments function. I hope the Development Conferences will continue."

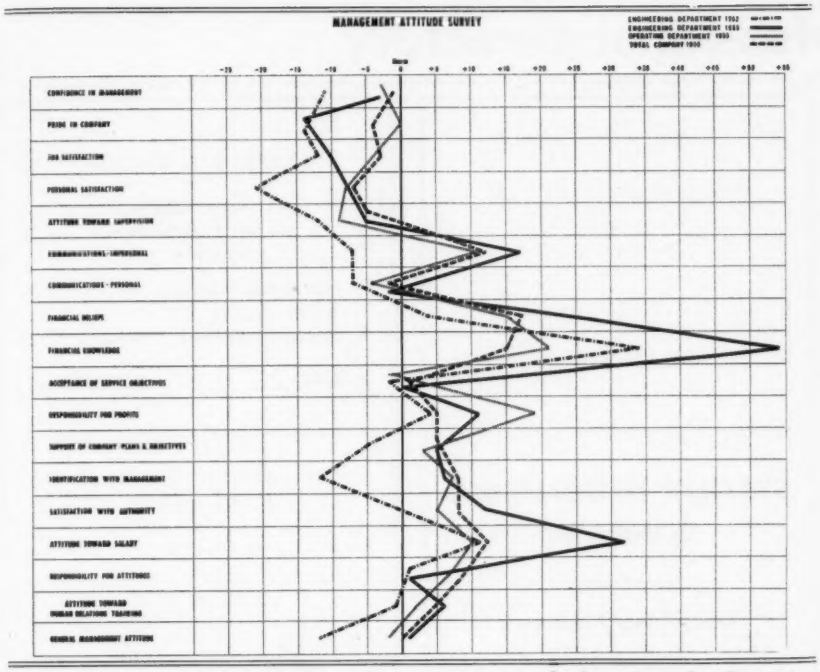
Based on the results to date there is no question but that this training has substantially broadened the outlook of the participants and laid the groundwork for a more capable management in the future.

Measurement of the Results

The programs to increase managerial ability and improve attitudes did not come into being all at once. We have always had activities of that character under way. However, the tremendous problems we have faced during the past ten years, resulting from a rapid growth in the demand for communication services, the introduction of a stream of technological improvements, a substantial increase in the requirement for supervisory personnel and a general shortage of people for all types of jobs, pointed up the fact that additional emphasis must be placed on the development of managers. As a result, many of the things I referred to were introduced in recent years.

To repeat, we feel that attitudes represent the critical factor in being a good boss—also, attitudes are susceptible to measurement. You saw a few minutes ago what measurement in this field showed for an Engineering Department, an Operating Department and a Company in 1952. Now I would like to show you the results from the same questionnaire for the same departments and company taken three years later. (Page 21.)

Referring to the chart; of most interest is the fact that the General Management Attitude of the Engineering Department is now above the score of the total Company. Giving some allowance to the fact that the Company figures represent a more diverse group of people, the comparison indicates that relatively



lower scoring in the Engineering Department is largely confined to one category, Pride in Company. This is more than offset by the strong scoring in Identification with Management, Satisfaction with Authority, Support of Company Plans and Objectives and Responsibility for Profits. By superimposing scores of the same Operating Department as before you will note comparable results — the Engineering Department now scores higher than the Operating Department in the critical measurement, General Management Attitude.

With reference to the scoring on Pride in Company, this category is composed of five questions. Four relate to off-the-job conversations on telephone matters with friends who do not work for the Company. The key question from the engineer's point of view is the fifth one which asks "How much pride do you have in working for the Company?" As 88% of the engineers answered it by saying "a great deal" we believe we are well on our way towards achieving acceptable results in this important area.

If we superimpose the 1952 score for the Engineering Department on the 1955 score you can see substantial progress has been made. This indicates clearly that it is possible to improve attitudes. There is no question but that the Department today is doing a far more effective job and the people in it are being better developed to assume positions of added responsibility.

You have seen from this study what we expect in my business of engineers as managers and supervisors, problems we found in developing engineers to become managers and supervisors, how we exposed these problems with attitude research and measurement, what we are doing to solve them and how it is paying off. Of course, we still have problems in developing management personnel—and we'll always have them as long as we continue to grow as a Company. We recognize, too, that there may be several roads to their solution—that each may be equally good. But we'll continue to study—experiment—and measure these many routes in an effort to more nearly reach perfection in developing the good engineer and the good engineering boss.

Tiny TV Camera

Great Britain has developed a hand-held underwater television camera which it claims is the world's smallest and cheapest, according to *Engineering News-Record.* All a diver has to do is aim the camera, which is buoyant in water. Spherical in shape and fitted with two handles, it can be operated in depths up to 250 feet. Focusing and other camera adjustments are made from a control position in a boat on the water.

Mexican Gas

Mexican gas will be piped to New England by way of the Texas-to-New England trunk system, starting next Fall, *Petroleum Week* reports. The Texas Eastern Transmission Corporation will spend $82.7-million for new facilities, which will include a 422-mile extension from Vidor, La., to the major gas area of Reynosa, Mex.

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Engineering Societies Personnel Service, Inc.

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Members of the societies shown above may publish a free advertisement on this page by registering at the nearest E.S.P.S. office. A weekly bulletin of Positions Open is available by subscription at $3.50 a quarter for members and $4.50 a quarter for non-members.

PLACEMENT FEES: The service is operated on a co-operative basis, whereby those actually placed in positions by the Service pay a fee in accordance with the established placement fee rates, which is 4% of the annual salary to members and 5% of the annual salary to non-members. HOWEVER MANY EMPLOYERS EITHER PAY FULL PLACEMENT FEE OR NEGOTIATE FEES.

POSITIONS AVAILABLE

C-5253 MATERIAL HANDLING ENGR. Ind. Mech. age 25-45; 2-4 yrs. in engr. layout, design, detail specification of conveyors; know material handling field. Duties: Staff position mfg. engr. service on call to contact all operating plants incl. with chem., metal working, electrical ind. & commercial appliances concerning material handling problem in receiving, mfg. warehousing & shipping; travel, car desired, for a mfg. engr. service; sal. $7-1400 loc. N.Y. empl. will negotiate the fee.

C-5299 ELECTRONIC APPL. & INSTALLATION ENGR. age 35-55, 5+ yrs. in utilization of carrier or tel. or telegraph eqpt. know communications systems. Duties: Field work on application & installation of field eqpt. based on orig. survey for a mfr. of communication eqpt. sal. up to $11,000 yr. loc. foreign & domestic, empl. will pay fee.

C-5304 NETWORK ANALYST ME or better EE, 3+ yrs. analyzing step by step automatic network. Duties: High level work on network synthesis des. of filters & equalizers, etc. for a mfr. of switchboards. Sal. $650-1100 mo. loc. Chgo. empl. will pay the fee.

C5383 CONST. SUPT. CE 4+ yrs. good solid field work supv. ind. constr. Duties: Representing Co. owner & supv. constr. of new bldg. mat'ls. plant, for a mfr. of bldg. mat'l. sal to $10,000 loc. Ill. empl. will pay the fee.

C-5436 COMPONENT ENGR. EE age up to 50; 1+ yr. in des., testing, or application of resistors, capacitors, filters & similar components, know military electronics. Duties: Ability to carry out a project with others & make reports for a mfr. of electronics sal. up to $10,000 loc. N.Y. empl. will pay the fee.

C-5443 ASST. CHIEF ENGR. ME to 50; 5+ yrs. supv. des. of hvy. mach'y Duties Resp, for managing every detail of engrg. dept. Work with des. in layout & detailing new des. Calculate stresses & clearances for a mfr. of hvy. mach'y. sal. $11-13,000 loc. Midwest empl. will pay the fee.

C-5737 OFFICE ENGR. grad. CE age up to 35; 2+ yrs. in highway work either in field or office. Duties: Office engrg. gathering & compiling data on highway & concrete technology able to write clear reports, some trav. for a trade assoc. sal. up to $7500 loc. Chgo. empl. will pay the fee.

C-5890 DESIGNERS STRUCT. BSCE 2+ yrs. exp. Duties: Designing & detailing all types of bridges for small consulting firms doing work on a national basis; exceptionally good fringe benefits sal. Open, loc. Mo. empl. will pay the fee.

C-5899 TECH. ASST. to V.P. of MFG. BSME age 30-40; 8-10 yrs. exp. mfg. production engrg. production control; know mfg. methods & procedures, tooling, machinery, etc. Duties: Deal with technical aspects of mfg. problems & make recommendations for their solution; study appl. of latest production methods, tooling & eqpt; suggest ways & means to reduce costs in collaboration with production control, production engineering product engrg., purchasing methods, etc. for a mfr. of hvy. & med. weight machinery sal. $10-15,000 loc. Chgo. empl. will pay the fee.

C-5919 MARKET RESEARCH & DEVEL. BS age 25-40 industrial exp. + exp. in economic eval. Duties: Market devel. for new lines; would work in a group of tech. men resp. for devel. new products some trav. no car req'd for a mfg. of plastics & paper sal. to $15,000 loc. Minn. empl. will pay the fee.

ENGINEERS AVAILABLE

540 MW PRODUCTION OR PLANT MGR. BSIE 35, 8 yrs. in metal fabrication-production planning scheduling-dies & tooling-supv. 500 people $10,000 East or Midwest.

541 MW WRITER — (WOMAN). BS chem. 42; 8+ yrs. dev. of anal. methods, in chem. research-liaison work between Co. & var. res. & testing labs. Report writing in chemicals, acids & petroleum. $8000 Chicago.

558 MW SR. ELECT. ENGR. EE 36, Check des. & proper installation of all electrical eqpt. associated with turbo generator units. $10,200 Chicago.

714-MW: QUALITY CONTROL MGMT. (electronics, chem. mech.) 34, BS, MBA. Seeking mgmt. level application of statistical quality control techniques; have had 8 yrs. exp. in applying scientific approach to economic research, quality control, design evaluation & evaluation of the reliability of electronic systems. $9400. Chgo.

713-MW: MFG. SUPERVISION, METHODS (metalworking) 38, BS-ME; extensive exp. in material handling, plant layout job evaluation, project engrg., supervision of industrial engrg. dept. for metalworking plant of 3000 employees. $10,000. Midwest or Southeast.

719-MW: PLANT & SALES ENGR. 36, some college; design & oper. of process eqpt. lubrication engrg. schedules specs. field problems; bldg. & eqpt. layout for construction of powder plants; 4 yrs. in sales & services of petroleum prod. to industrial & motor fleet accts. $7,200. Midwest, South, West.

Reviews of Technical Books

Surveying

Surveying for Civil Engineers, by Philip Kissam, McGraw-Hill Book Company, Inc., New York 36, N.Y. 1956. 716 pages. Price $8.50.

The engineer who designs and directs large, important, or especially accurate surveys will find that this book answers, or helps him with his many problems. The men who assist him will find guidance. It may also serve as a text for civil engineering students and for those men who do the actual surveying on such projects.

Kissam states that his aim is to present material that will further advance the economics already attained in engineering construction. Consequently, emphasis has been placed on new and improved instruments and methods. He has also stressed the theory of errors and the adjustments of survey nets so that the accuracies of survey methods can be quickly appraised and the best use can be made of survey data.

In this text the material is presented by types of surveys rather than by details of operation. The most recent advances in instruments, field methods, data reduction and photogrammetry are presented.

Philip Kissam is Professor of Civil Engineering at Princeton University.

R.G.G.

Business Management

Business Management Handbook, editor, J. K. Lasser, prepared by 20 specialists, McGraw-Hill Book Company, Inc., New York 36, N.Y. Revised 1954. 809 pages. Price $8.50.

This guidebook, which includes factual help in vital problems that arise in business management, should prove valuable to the executive and to the inexperienced businessman as well.

Lasser says that this book was the result of his own effort to get from experts the answers to a lot of normal questions asked by business men.

Twenty specialists in the business world have each contributed a chapter. These deal with various problems an executive must face. Explanations conducive to the development of more efficient and effective authority in top management are stressed. Many business practices are covered such as, organizing and locating a business, buying or selling an established one, or perhaps doing business abroad.

The material was first used as *J. K. Lasser's Executive Course in Profitable Business Management.*

It also deals with each departmental operation from the top down, with suggestions on marketing and public relations.

R.G.G.

Electrical Engineering

Introduction to Electrical Engineering, by George V. Mueller, McGraw-Hill Book Company, Inc., New York 36, N.Y. 1957. Third edition. 466 pages. Price $7.50.

This third edition of a text that presents the fundamental principles of electric and magnetic circuits and fields, has been divided so that the first eight chapters may be used for a one-semester course, and the remaining chapters may be used for a subsequent course or as reference material.

Mueller has emphasized the application of these principles to the solution of typical problems, both for assignments and for self-study.

New material in this edition includes: tetrodes, pentodes, cathode-ray tubes, photoelectric tubes, transitors, magnetic amplifiers, the piezoelectric effect, and magnetrostriction. The numerous drawings have been up-dated to bring graphical symbols into agreement with the most recent specifications of the American Standards Association.

George V. Mueller is Professor of Electrical Engineering at Purdue University.

R.G.G.

Dielectric Behavior

Dielectric Behavior and Structure, by Charles Phelps Smyth, McGraw-Hill Book Company, Inc., New York 36, N.Y. 1955. 441 pages.

This text is especially valuable to students interested in the chemistry, physics, and engineering of insulators of all types, as well as to those interested in the study of organic molecules.

Smyth first published his work in this field twenty-five years ago. Since then knowledge has grown to such an extent that this new book is the result.

The first part of the text explains the relations between the molecular structure of matter and the dielectric behavior of matter. It uses the experimental measurements of dielectric constant and loss and electric dipole moment to investigate the nature of liquids and solids, and it studies molecular structure.

The latter part of the text gives an extensive account of the use of dipole moment in the determination of molecular structure and studies the nature of chemical bond, resonance, and intramolecular energy.

Charles Phelps Smyth is Professor of Chemistry at Princeton University.

R.G.G.

CTA Has Program Of "Defensive Driving"

In cooperation with the national "Back the Attack" on traffic accidents, Chicago Transit Authority has underway at its 13 surface operating stations an intensive "Defensive Driving" program as part of its continuing effort to promote safety and to reduce traffic and passenger accidents, CTA General Manager Walter J. McCarter announced.

The program re-emphasizes safe-driving principles, defines the driving standards of a professional bus driver, and stresses defensive driving techniques designed to prevent the occurrence of accidents under conditions operators face daily, McCarter explained.

"By this effort, which reviews defensive actions that can be taken by operators to avoid vehicular, passenger and pedestrian accidents, we hope further to reduce surface system accidents," said McCarter. "It is still another phase in CTA's continuing campaign to increase passenger safety and assure our patrons that our operators are competent and qualified to drive public transit vehicles."

Two specially-equipped training buses are being used to carry the defensive driving program to bus operators and streetcar crews. These buses make a tour of the 13 surface system stations at which the program is being conducted and where briefing sessions are held to acquaint operating personnel with the objectives of the campaign.

The sessions include an illustrated presentation on common traffic problems which confront surface vehicle drivers and a review of defensive actions to be taken to cope with the various situations.

Each operator receives a "Defensive Driving Guide" which illustrates a number of the more frequent traffic situations encountered on the streets, and explains what defensive action the driver should take to reduce the possibilities of accidents.

The following defensive actions are suggested to prevent vehicle accidents:

—If other vehicle ahead, maintain proper following distance; watch traffic ahead; stop proper distance from standing vehicles.

—If other vehicle behind, signal traffic behind when slowing down or stopping; make slow, gradual stops; make authorized stops only.

—If other vehicle approaching from opposite direction, keep to right hand side of lane; slow down—stop if necessary; do not rely completely on signals of other drivers.

—If other vehicle approaching from an angle, look in all directions before entering intersections; be prepared to stop.

—If other vehicle passing, slow down or stop to allow vehicle to cut in safely; maintain proper distance between bus and curb to prevent possibility of passing on right hand side.

—If other vehicle being passed, warn other drivers before starting to pass; maintain proper distance between bus and vehicle; observe parked vehicles for signs of occupancy.

Operators are also instructed in proper defensive actions to prevent accidents involving passengers and pedestrians.

As a follow-up effort to the formal presentation, one phase of defensive driving is being emphasized each week over a six-week period.

"The problem of traffic accidents becomes more serious daily because of the ever-increasing number of vehicles on the street and because the majority of drivers are not trained in safe-driving principles," said McCarter. "The solution to the problem of reducing accidents lies with drivers who drive defensively, who drive so that they do not cause accidents themselves and so that they avoid being involved in accidents caused by untrained and inattentive drivers."

New Method

Reversing the usual sequence of first excavating, then building, the contractor of a new dome-roofed civic auditorium in Albuquerque, New Mexico, rounded off a natural mound of earth on the site and cast a 218-foot thin-shell concrete roof on the convex surface, reports *Engineering News-Record*. He then dug away the earth beneath, leaving the dome standing clear on a ring of columns which had been built and backfilled earlier.

WSE Personals

M. K. Fahnestock, research professor of mechanical engineering and chairman of the Physical Environment Unit of the University of Illinois, has been selected to receive the F. Paul Anderson Medal, highest award of the American Society of Heating and Air-Conditioning Engineers.

The presentation will be made by society president John W. James at the annual banquet concluding the 63rd Annual Meeting of the Society, February 25-28, 1957 in Chicago, Ill.

The F. Paul Anderson Medal is awarded by the society in recognition of outstanding work in the field of heating, ventilating and air conditioning. An endowment fund for this award was established in 1930 by the late Thornton Lewis at Philadelphia, Pa., who was president of the society in 1929. Dean F. Paul Anderson of the University of Kentucky, for whom the award was named, was society president in 1927. The first recipient of the award was Dr. Willis H. Carrier in 1932.

* * *

James N. Van Scoyoc has been named to one of the top professional positions at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Van Scoyoc has been promoted to engineering advisor, a new position reserved for the recognition of outstanding technical achievements, according to Virgil H. Disney, manager of the electrical engineering research department.

Primarily engaged in electronic design and development, Van Scoyoc has worked in the fields of electronic instrumentation, transistor circuits, and developments utilizing magnetic, photoelectric, and semiconductor-components. He also is the author of a number of technical articles.

Van Scoyoc joined the Foundation in 1946 as an associate engineer and was promoted in 1948 to senior engineer, a position he held until his appointment to engineering advisor.

* * *

Fred C. Kellogg, president of Pioneer Service & Engineering Co., announced the election on Dec. 12, 1956 of Edward M. Imhoff as treasurer of the company.

Imhoff, a certified public accountant, comes to Pioneer from the Federal Power Commission where he held the position of assistant chief, bureau of rates and gas certificates, specializing in electric and natural gas rate matters and natural gas certificate proceedings. He joined the Commission's staff in 1939, prior to which time he served on the accounting staff of the Public Service Commission of Wisconsin for seven years. He graduated from Marquette University in 1926 and spent three years in the public accounting field before going with the Wisconsin Commission.

* * *

The opening of a new factory, located at 2500 W. Bradley Place, Chicago, Ill., in the Mid-City Industrial Center, has been announced by the Bodine Electric Co., 2254 W. Ohio St., Chicago 12, Ill. The new building has a floor space of 148,000 square feet, and will permit the consolidation of all company manufacturing operations under one roof. It is anticipated that Bodine motor production, which has shown a steady increase over the past six years in spite of limited plant facilities, will benefit greatly from the improved operating efficiency and additional machinery now possible in the new building. Twenty acres of land have been set aside for future plant expansion. This will permit an approximate 300 per cent increase in factory space over and above the new plant now built.

Construction of a two-floor office building, to be located directly front-center of the factory, is to be started in the near future. In the meantime, Bodine's present Ohio St. offices will be expanded, now, with the availability of former factory space.

The Mid-City Industrial Center, location of Bodine's new plant, is a new light manufacturing development, and occupies an area of 57 acres. As the name implies, it is close to the Chicago business district. It was formerly the Mid-City Golf Course, and approximately 21 acres of land are still unoccupied and will be sold for industrial use.

* * *

Dr. Melvin W. Aarons has recently joined the technical staff of Bjorksten Research Laboratories, Inc. as senior physicist in the solid state physics section, it was announced in Milwaukee.

Dr. Aarons was previously associated with Armour Research Foundation and Battelle Memorial Institute. His work with these organizations included direction of research in transistor metallurgy, surface passification problems with germanium and silicon, and properties of crystal imperfections in silicon and certain inorganic explosive crystals. He is also experienced in electron paramagnetic absorption and infrared polariscope techniques.

DON'T FORGET

When the public relations man or reporter contacts you about your new promotion or other good news, be sure to tell him you belong to WSE.

CRERAR LIBRARY

News and Notes

Beginning in January 1957, Research Information Service will become a participant in the program of the American Society of Metals in the preparation of abstracts of current metals literature. Most engineers are probably familiar with the ASM publication, *Review of Metals Literature* which reports extensively on new books and periodical literature of interest to metallurgists and the metal industries.

ASM is sponsoring a research project now in progress under which the Center for Documentation and Communication Research at Western Reserve University in Cleveland is investigating the potentialities of machines for storage and retrieval of metals information. This organization has constructed a computing-type machine which will be used for a pilot project in the storage and retrieval of metals literature.

As a step toward coordinating the literature and information services of ASM, the Society has engaged the Center of Documentation and Communication Research to establish a unit for current review of metals literature. Under a subcontract for this part of the ASM program, Crerar Library will peruse some 2500 current periodicals and other publications to identify papers which should be reported in *Review of Metals Literature*. The text of these will be microfilmed and forwarded to Cleveland for abstracting. As a part of the program, ASM will also use a substantial proportion of the abstracts of literature relating to titanium, zirconium and other metals which are currently reported in *Crerar Metals Abstracts*.

This project offers an unusual opportunity to experiment with the possibilities of cooperation between centralized abstracting and indexing agencies such as ASM and specialized abstracting services such as those published by Crerar Library.

* *

During the last two weeks of December, Mr. Zin Maung of Burma will serve as an intern in Crerar Library. Mr. Maung has just completed work for his Master of Science in Library Science at the Graduate Library School, University of Chicago, where he has been a student under sponsorship of the Burmese government. Following his tour of duty at Crerar, Mr. Maung will visit technical libraries on both the Atlantic and Pacific coasts, after which he will return to Burma to become librarian of the Union of Burma Technical Information Center. This institute is administered by the Armour Research Foundation under contract with the Burmese government.

* *

The Librarian of Crerar, Herman H. Henkle, is serving on the executive committee of The Council on Documentation Research which is the principal sponsor of a Symposium on Systems for Information Retrieval which is scheduled for April 15-17, 1957, at Western Reserve University in Cleveland. The Symposium will be organized around such broad topics as: criteria for systems design, semi-automatic systems, coordinated systems, systems using accounting or statistical machines, and systems using computer or computer-like devices.

Forces and Factors

A study of the forces and factors that contribute to people's well-being is being undertaken at the Kansas Power & Light Company, reports *Electrical World*. A research team from the Menninger Foundation, psychiatric treatment center, is seeking to develop methods for obtaining some kind of composite view of the human relations in an entire business organization.

End to Restrictions On Wood Called for

The head of the nation's largest carpenters' union proposed Nov. 9 in Washington, D.C., that lumber manufacturers and union leaders join in a "vigorous campaign" to wipe out "restrictions" against the use of lumber and wood products in building construction.

Maurice A. Hutcheson, president of the United Brotherhood of Carpenters and Joiners, invited the lumber industry to work with his 850,000 members in a cooperative program aimed at stepping up the promotion of lumber and wood products in all phases of the building picture.

Addressing the 1956 annual meeting of the National Lumber Manufacturers Association, Hutcheson called for immediate action to correct "outmoded building codes and prohibitive insurance rates" as they relate to lumber and wood products.

"Some building codes . . . date back as much as a half century. We need up-to-date codes which recognize all the improvements in both product and technique that have been developed in wood construction in the past 50 years.

"Case histories prove that fire losses are lower for wood structures than for buildings containing metal members which buckle and warp under moderate heat conditions. Yet wood has been penalized in both building codes and fire insurance rates."

On Talent

Hide not your talents. They for use were made. What's a sun dial in the shade. —Poor Richard's Almanack

Obituaries

The Western Society of Engineers has recently been notified of the following deaths:

Harvey F. Wagner, member of the Western Society since 1928 passed away on November 3, 1956 after an extended illness. As a structural engineer, Mr. Wagner was, for many years, attached to the Illinois Power & Light Corporation and the City of Chicago Department of Subways and Highways. More recently he was connected with DeLeuw, Cather and Company.

Mr. Wagner was a frequent contributor of book reviews and other articles which appeared in Western Society Publications.

He is survived by his widow, Ruth, a son Charles D., of Pleasant Hill, California, a daughter, Mrs. G. B. Clappison, of Yakima, Washington, and six grandchildren.

* * *

George W. Hamilton, a member of the Western Society since 1928, died on August 30, 1956. Mr. Hamilton for 56 years had been professionally associated with the major phases of operation of electric utilities, including developing, designing, constructing, operating, administering, and marketing power.

Noted as a builder of dams, Hamilton Dam, in Texas, was named in his honor.

In addition to his many other professional duties, Mr. Hamilton appeared as an expert before state and federal bodies, before county courts, and the United States Court of Claims.

He was a Fellow and Charter Member of the American Institute of Electrical Engineers (1905), and a life member of the American Society of Civil Engineers, in addition to his membership in the Western Society of Engineers.

* * *

Hans J. Zack, who became a member of the Western Society of Engineers in 1936, died on October 6, 1956. Mr. Zack had been prominent as a sheet metal and ventilating contractor, and was president of his own firm, founded in 1921.

* * *

J. Frank Lyman, a member of the Western Society since 1920 and a life member since 1952, died July 31, 1956. He had been president of the W. H. Lyman Construction Company.

Day of Part Time Inventor Said Past

The day of the lone, part-time inventor is past.

Technological progress today demands the team approach to research, according to Dr. E. H. Schulz, assistant director at Armour Research Foundation of Illinois Institute of Technology.

Schulz spoke at the Flamingo Hotel in Tucson, Ariz. on Oct. 24 at a dinner meeting of the Associated University Bureaus of Business and Economic Research.

"For many years the world was dependent upon the lone inventor for its technological progress," Schulz stated. "It was such inventiveness that produced the electric bulb, the wireless, the mechanical harvester, the automobile, and many other notable developments."

Many of these early scientists, engineers, and thinkers, he said, continued their experiments on a part-time basis in their basements, attics, or backyards. There were virtually no full-time scientists or engineers as we know them today, he pointed out.

"However, with the increasing population and the expansion of industry came the need for a steady stream of new and improved materials, processes, and products," Schulz stated, adding:

"It was during this period of need—in the latter part of the 19th century—that organized research and development came into existence in the United States and the other more advanced industrial countries."

That was the beginning of the eclipse of the independent inventor, Schulz asserted, pointing out that in the years that followed scientific inquiry was placed on a more formal basis, with much of the research and development being carried out in company and university laboratories.

This development was made necessary, he stated, because many of the problems of today are too vast in scope for a single individual to cope with and require the team effort—the diverse talents of many scientists and engineers.

Speaking on the topic, "Research on a Limited Budget," Schulz pointed out that research has become firmly established as a necessary function for healthy industrial growth, for outdistancing competition, for avoiding obsolescence, and for making greater profits.

"The question for most companies no longer is 'Can I afford research?' but 'Can I afford not to do research'", Schulz declared.

While a highly specialized company can adequately meet most of its research needs, Schulz pointed out, the company with problems falling in several scientific fields must depend upon contract research to a larger extent. "This is particularly true," he said, "of the small companies that cannot afford a diversified staff and the necessary supporting equipment."

To adequately exploit contract research, Schulz continued, the company must understand research; it must use great care in the choice of a research organization; and it must maintain close contact with the researchers throughout the project.

"In this way," he said, "the small company makes available to itself—at relatively little cost — a highly skilled and well equipped staff covering virtually all fields of science and technology."

New Award Honors Young Researchers

A major new award in engineering education, to recognize the research potential and accomplishment of young workers engaged in engineering research in a college or university, will be given for the first time in June, 1957.

The Engineering College Research Council of the American Society for Engineering Education on Oct. 24 announced plans for the Curtis W. McGraw Research Award, established in memory of the late Curtis W. McGraw, president of the McGraw-Hill Publishing Company from February, 1950, to September, 1953, and brother of Donald C. McGraw, now president of the company. The award, sponsored by the McGraw-Hill Book Company, will include a cash prize of $1000 and will be given annually beginning next June.

Candidates are to be young men "who have made original contribution in engineering research and who have demonstrated high potential for future leadership."

In announcing the new award, Raymond J. Woodrow of Princeton University, chairman of the Engineering College Research Council, pointed out that it is the second major award in engineering college research administered by the American Society for Engineering Education through the Council. The Vincent Bendix Research Award, for contributions to the development of research activities and their management, was first made last June (1956) to Dr. Clifford C. Furnas, chancellor of the University of Buffalo and assistant secretary of defense for research and development.

"The development of these two awards," said Dr. Woodrow, "serves to emphasize the growing importance of basic research as a part of engineering education. Both teachers and their students benefit from their participation in active research undertakings on their campuses. Indeed," declared Dr. Woodrow, "this kind of research is our best assurance that today's engineering students will graduate well equipped to meet tomorrow's needs."

The recipient of the McGraw Research Award will be selected each year by a special committee of the Engineering College Research Council.

Index of MIDWEST ENGINEER *Advertisers*

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WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

46-56 Albert L. Rodkin, Project Engineer, A. Froehlich, Architects - Engineers, 203 S. 15th St., Philadelphia, Pa.

47-56 Charles E. Templeman, Engineering Consultant, 2438 N. Major Av.

48-56 John R. Swanton, Partner, Consoer, Townsend & Associates, 360 E. Grand Av.

49-56 Russell P. Hill, 211 E. White St., Champaign, Ill.—attending University of Illinois.

50-56 Frank A. Berczynski, Co-op. Student, Illinois Institute of Technology.

51-56 Isadore LaMantia, Designer, Illinois Central Railroad, 135 E. 11th Pl.

52-56 S. W. Lin, Estimate, Design Bridge, American Bridge Div., United States Steel Corp., 208 S. LaSalle St.

53-56 W. K. Waltz, Signal Engineer, Elgin, Joliet & Eastern Railway Co., Joliet, Ill.

54-56 William V. Sayner, Staff Supervisor, American Telephone & Telegraph Co., 20 N. Wacker Dr.

Atlantic Flights

Airlines will offer an average of 10,500 seats a week for transatlantic travel this Winter season, *Aviation Week* says.

Rettaliata Speaks For Math Training

Declining attention given mathematics in American high schools may be largely responsible if this country loses the race for scientific and technological supremacy to Russia.

This was the opinion expressed Nov. 19 by Dr. John T. Rettaliata, MWSE, president of Illinois Institute of Technology, Chicago, in warning that the Soviet secondary school graduate "has a much better foundation for science and engineering study at the higher level."

Rettaliata spoke at a Parent-Teacher Association meeting at Kellogg school.

Pointing out that mathematics is fundamental to all of the sciences, he cited studies showing that lack of proper prerequisite courses is the reason for 25 per cent of rejections by college admissions officers.

At Illinois Tech, he added, a poor background in mathematics is responsible for the largest percentage of rejections.

Rettaliata said an increasing number of high schools are offering mathematics only as an elective in the ninth grade, and that often the course is one called "general math," which, he added, is "not a rigorous treatment of the subject."

The Russian educational system, he said, is designed to assure continued expansion of the country's scientific and technological manpower supply.

Noting that the Russian system permits no elective subjects, Rettaliata explained that every Soviet student has taken five years each of physics and biology, four of chemistry, one of astronomy, and 10 of mathematics by the time he has graduated from the Russian secondary school.

The Illinois Tech president also cited an Educational Testing Service survey which found that "a large proportion of high school students drop mathematics as soon as they are free to do so."

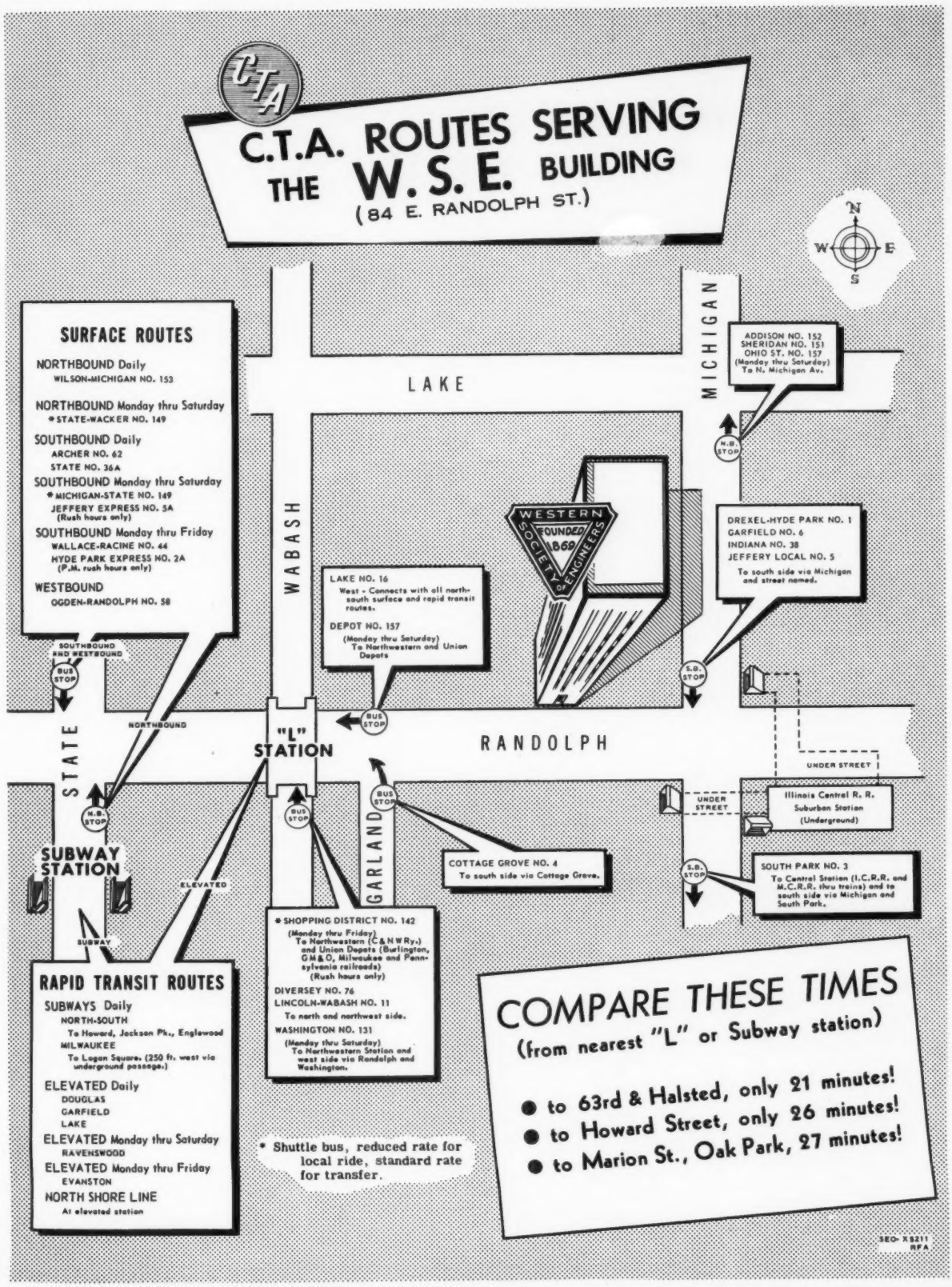
A survey of high school seniors showed that 12 per cent had taken no algebra or geometry, 26 per cent had dropped mathematics after one year, and 30 per cent after two years.

Teachers, too, apparently have little liking for mathematics. A National Education Association study, Rettaliata said, found the number of college students completing high school teaching certificate requirements in mathematics declined 50 per cent between 1950 and 1954.

Rettaliata urged united action to strengthen mathematics instruction.

"The situation confronting us has been in the making for some time and will not be quickly corrected," he said.

"Much is needed . . . mathematics programs revised and up-dated . . . better teacher preparation in the subject . . . and instruction methods revised to make the courses more interesting and meaningful. Teaching mathematics does not have to be dry and uninteresting."


C.T.A. ROUTES SERVING THE W. S. E. BUILDING
(84 E. RANDOLPH ST.)
N
W
E
S
SURFACE ROUTES
NORTHBOUND Daily
WILSON-MICHIGAN NO. 153
NORTHBOUND Monday thru Saturday
*STATE-WACKER NO. 149
SOUTHBOUND Daily
ARCHER NO. 62
STATE NO. 36A
SOUTHBOUND Monday thru Saturday
*MICHIGAN-STATE NO. 149
JEFFERY EXPRESS NO. 5A
(Rush hours only)
SOUTHBOUND Monday thru Friday
WALLACE-RACINE NO. 44
HYDE PARK EXPRESS NO. 2A
(P.M. rush hours only)
WESTBOUND
OGDEN-RANDOLPH NO. 58
LAKE
MICHIGAN
WABASH
STATE
RANDOLPH
GARLAND
ADDISON NO. 152
SHERIDAN NO. 151
OHIO ST. NO. 157
(Monday thru Saturday)
To N. Michigan Av.
N.B. STOP
LAKE NO. 16
West - Connects with all north-south surface and rapid transit routes.
DEPOT NO. 157
(Monday thru Saturday)
To Northwestern and Union Depots
WESTERN SOCIETY OF ENGINEERS FOUNDED 1869
DREXEL-HYDE PARK NO. 1
GARFIELD NO. 6
INDIANA NO. 38
JEFFERY LOCAL NO. 5
To south side via Michigan and street named.
S.B. STOP
SOUTHBOUND AND WESTBOUND
BUS STOP
NORTHBOUND
"L" STATION
UNDER STREET
Illinois Central R. R.
Suburban Station
(Underground)
SUBWAY STATION
ELEVATED
SUBWAY
COTTAGE GROVE NO. 4
To south side via Cottage Grove.
SOUTH PARK NO. 3
To Central Station (I.C.R.R. and M.C.R.R. thru trains) and to south side via Michigan and South Park.
* SHOPPING DISTRICT NO. 142
(Monday thru Friday)
To Northwestern (C & N W Ry.) and Union Depots (Burlington, GM & O, Milwaukee and Pennsylvania railroads)
(Rush hours only)
DIVERSEY NO. 76
LINCOLN-WABASH NO. 11
To north and northwest side.
WASHINGTON NO. 131
(Monday thru Saturday)
To Northwestern Station and west side via Randolph and Washington.
RAPID TRANSIT ROUTES
SUBWAYS Daily
NORTH-SOUTH
To Howard, Jackson Pk., Englewood
MILWAUKEE
To Logan Square. (250 ft. west via underground passage.)
ELEVATED Daily
DOUGLAS
GARFIELD
LAKE
ELEVATED Monday thru Saturday
RAVENSWOOD
ELEVATED Monday thru Friday
EVANSTON
NORTH SHORE LINE
At elevated station
* Shuttle bus, reduced rate for local ride, standard rate for transfer.
COMPARE THESE TIMES
(from nearest "L" or Subway station)
● to 63rd & Halsted, only 21 minutes!
● to Howard Street, only 26 minutes!
● to Marion St., Oak Park, 27 minutes!
SEO- X5211
RFA

Meet the Automatic Detective Force on the Commonwealth Edison System

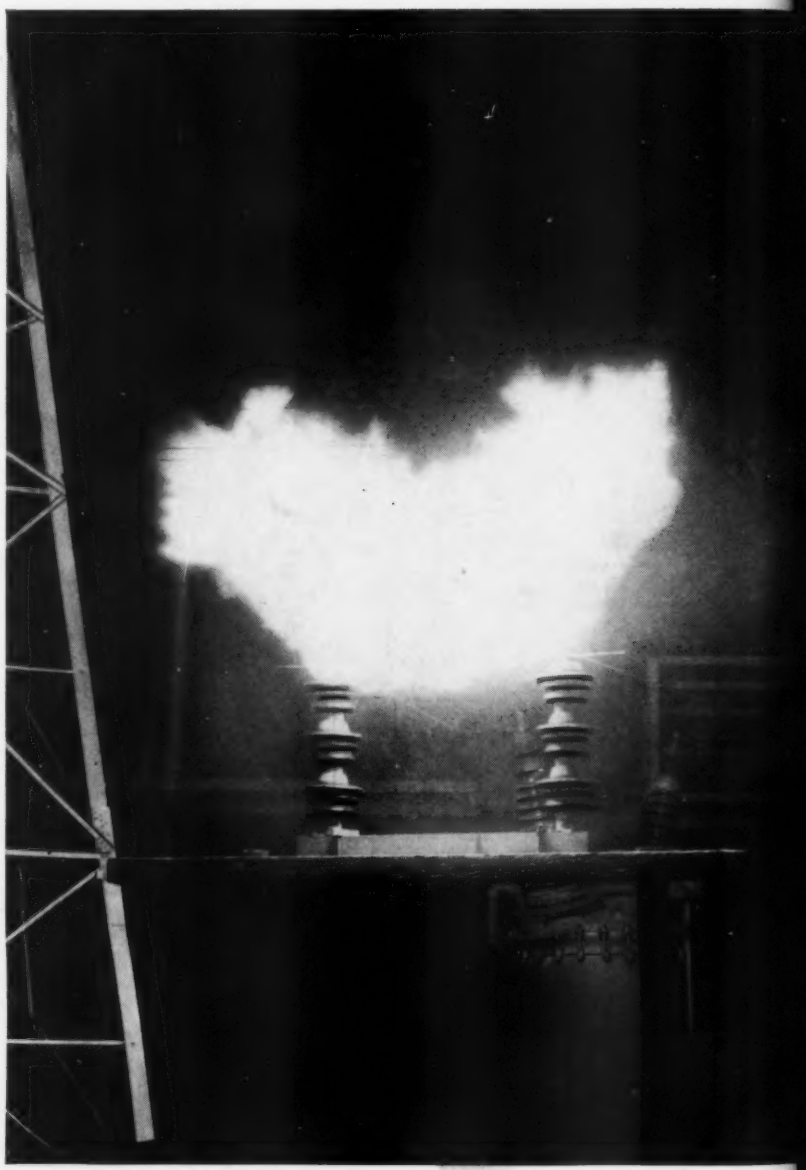
Detects the disturbance . . . and arrests the culprit...in 1/10 second

Occasional electrical failures on a power system are inevitable. There is always the possibility of severe lightning, sleet and windstorms to keep us from a perfect record. Even birds, animals or freak accidents sometimes cause short circuits.

This is where our automatic detective force—protective relaying—takes over. Power relays are sensitive instruments which detect system disturbances and act to correct them by operating circuit breakers to isolate the trouble—almost instantaneously! The addition of electronic carrier-current equipment adds high-speed selective control to these relays. Literally these relays think before they act.

But relays are only tools. How engineers apply these tools determines their efficiency in this highly technical and challenging field. Commonwealth Edison engineers have made substantial contributions to the power industry's basic relaying philosophy. It is top-flight engineering, such as this, that is reflected in better, low-cost, more dependable service for the 6 million people we serve.

Engineers George Applegren & Glenn DeViney inspect equipment designed to minimize trouble from short circuits. These protective relays detect electrical failures and quickly operate the correct circuit breakers to disconnect the fault from the power system.



A short circuit, like the one shown above, on a 138,000-volt system could cause service interruption and damage to valuable equipment if not quickly extinguished.

Commonwealth Edison
AND
Public Service Company

Pioneers in Progress for over 69 years